

Winchester Repeating Arms Company: Tract K
Shooting Range (Winchester Research Group,
Ballistics Laboratory Test Range)
Rear section of 125 Munson Street
New Haven
New Haven County
Connecticut

HAER No. CT-28

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
MID-ATLANTIC REGION, NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR
PHILADELPHIA, PENNSYLVANIA 19106

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Winchester Repeating Arms Company: Tract K Shooting Range
(Winchester Research Group, Ballistics Laboratory Test Range)

HAER No. CT-28

Location: Rear section of 125 Munson Street, adjacent to former New York, New Haven and Hartford Railroad tracks, New Haven, New Haven County, Connecticut

USGS Quadrangle: New Haven
UTM Coordinates: 18.673320.4576190

Date of Construction: 1916; modified c. 1946

Architects: Possible original architect: Leoni Robinson
Possible modification architects: Westcott & Mapes

Present Owner: Olin Corporation
120 Long Ridge Road
Stamford, Connecticut 06902

Present Use: Vacant; last used as U. S. Repeating Arms Company Quality Control Testing Laboratory, to mid-1985; demolition anticipated after mid-1986

Significance: Winchester, perhaps the world's largest sporting arms ammunition manufacturer by World War I with a strong sporting rifle product line, entered large-scale military production in 1914 with British, Belgian, and Russian contracts. The firm doubled its plant size at this time, including the construction of a six-story factory space on Tract K for British Enfield rifle manufacture. The small firing range, built at the rear of Tract K in 1916, was a testing facility for finished British Enfields and, after 1917, for the American Enfield adapted by the U. S. Army. After the war, Winchester's plant exceeded sporting arms market demands, and Tract K was closed to small arms production or research until 1946, when the firm, by then a division of Olin Corporation, established a research department and remodeled the firing range. Industrial research and quality control, with a nationally-owned photographic section, continued until 1985.

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Project Information: This documentation was prepared in January 1986, in accordance with the Memorandum of Agreement among the Economic Development Administration, the Advisory Council on Historic Preservation, and the Connecticut State Historic Preservation Officer, as a mitigative measure prior to partial demolition of the shooting range for development by Science Park Development Corporation (5 Science Park, New Haven, Connecticut 06511), the new owner of the property.

Research Conducted by: Michael S. Raber, owner
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New Haven, Connecticut 06520

PART I. HISTORICAL INFORMATION

Industrial production of small arms in the Connecticut Valley began at the federal Springfield and private Whitney armories around the turn of the nineteenth century, with manufacture of muskets and, later, rifles for the U. S. Army. These rifles were muzzle-loading, large bore weapons, used in wars between 1812 and 1865. Production of the same basic rifle, converted to breech loading, continued at Springfield until the beginning of magazine rifle production there in 1892.

The Winchester Repeating Arms Company represents a separate line of development of the Connecticut Valley small arms industry. Williamson (1952) covers the firm's early corporate development. Beginning in 1866, it developed, manufactured and sold lever action repeating rifles, as well as the metallic cartridges required for these new weapons. The Winchester rifle was a lighter weight, shorter range arm than the heavy, single shot rifles favored by the Army. It was particularly suited to the needs of farmers, ranchers, and other settlers in the American West. The Winchester Company had a superior product and, through a determined sales effort, became the best known rifle maker in the United States around 1875. Until 1914, it had very little to do with military small arms (Colby 1957).

A repeating rifle, unlike the muzzle loader, required design for a specific metallic cartridge. Winchester's success began with B. T. Henry's development of the .44 calibre rim fire cartridge, for which he then designed the rifle that became Winchester's first product. Ammunition production was always an integral part of the Winchester business and, as competitive pressures grew, the number of new cartridges developed by the company increased; the firm introduced one type in the decade 1860-69, six in 1870-79, and 16 in 1880-89. The commercial availability of smokeless powder, c. 1890, provided Winchester with new development and marketing opportunities. Because smokeless powder could be made to burn more slowly than the black powder previously used for small arms, much higher bullet velocities could be attained with new cartridges and rifles designed to take advantage of the smokeless powder properties. Between 1890 and 1910, Winchester developed 17 new smokeless cartridges and altered 19 previous designs for smokeless powder.

Ammunition development led to the need for ballistics test facilities. The Winchester complex in New Haven, begun in 1870-71, apparently had a specific firing range used for this purpose along the railroad tracks north of Munson Street. T. G. Bennett began ballistics laboratory work on an informal basis in 1886, with the purchase of a Boulenger chronograph, an instrument for the measurement of bullet velocities. Bennett, a Civil War veteran and 1870 graduate of the Sheffield Scientific School, joined the Winchester company in 1870 and became its president in 1890. He was the first Winchester executive

to have a technical background, and continued to emphasize formal training in his selection of the research management personnel. Results of his experimentation appeared as a small ballistics table in the 1889 Winchester catalog. The ballistics laboratory, under E. L. Uhl, began full time operations in 1894, working on new cartridges, priming mixtures, and annealing of brass cartridge cases. A chemical division of the laboratory began in 1901 under Joseph Will and, later, William Buell. Private inventor John M. Browning adapted one product of the laboratory--the .30 WCF or ".30-30" Winchester cartridge--to his lever action Model 94 rifle; Winchester has since sold well over 1.5 million sales of these weapons, with rights purchased from Browning. By 1905, Winchester manufactured 100 varieties of smokeless cartridges; by 1914 the number had increased to 175, encompassing virtually all commercially-available types of sporting ammunition. The Winchester laboratory developed at least 25 of these types (Williamson 1952; Colby 1957).

None of Winchester's early laboratory facilities included Tract K south of Munson Street. During the firm's first forty years in New Haven, the extensive plant for rifle manufacture, cartridge making, and ammunition priming grew north of Munson Street in several stages. World War I changed both existing production facilities and some contiguous open spaces, and Winchester for the first time entered a wartime market for military small arms. In 1914, Winchester contracted for large-scale production of rifles, ammunition and other supplies with Britain, Belgium, and Russia. With financing provided largely by J. P. Morgan & Co., the rifle company built about a dozen new factories and storehouses, two power plants, and a rolling mill. Leoni Robinson, perhaps New Haven's best known architect of industrial structures in the early 20th century, designed most of the new plant in reinforced concrete. Floor space in the plant doubled between 1914 and 1916.

Part of this program included construction of a six-story concrete factory complex on Tract K, previously occupied by a much-smaller storage building (see Figure 1, buildings 1-K, 2-K, and 3-K). The Tract K factory arose to meet one of Winchester's largest wartime contracts, for manufacture of the Enfield rifle and its .303 cartridge, then used by the British Army. Enfield production occurred large or entirely in Tract K, which Winchester planned to expand towards the south. For undocumented reasons, perhaps related to contract difficulties, Winchester halted construction of the expansion program and instead built a one-story rifle range behind the existing Tract K factory in 1916. The range building is a largely timber-frame, brick-clad structure with one reinforced concrete end, unusual among Winchester facilities built during World War I and perhaps a product of very hasty planning and construction. The British contract called for production of 200,000 Enfields. Winchester fell behind the delivery schedule specified because of difficulties in acquiring the necessary machine tools and the rather stringent quality standards set by the British inspectors. The contract was renegotiated and, eventually, 235,000 Enfields and 99 million rounds of .303 ammunition were

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completed, with the 100-foot ranges used for proof, accuracy, and function testing of finished rifles, and possible for batching of rifles prior to shipment (Williamson 1952; Brown 1976; personal communication, Henry Bialecki, January 3, 1986).

When the United States entered World War I, the Army did not have the rifles for an expanded force, and the Federal armories at Springfield and Rock Island were not prepared to make the Model 1903 Springfield rifle, then the service standard, in adequate quantities. As an alternative, which accounted for private production capabilities, the Army decided to adopt the Model 1917 Enfield rifle, rechambered for the U. S. .30-06 cartridge, as the standard rifle for the wartime U. S. Army. With this modification, Winchester continued to make Enfields in Tract K, and produced 545,511 rifles in New Haven, using the Tract K firing range.

In 1919, the Winchester Company found itself with a physical plant greatly in excess of its needs. The company attempted to enter the hardware and sporting goods business, in order to use some of its excess manufacturing capacity, but most of Tract K remained largely unused or leased to small non-Winchester firms. The burden of excess plant and the failure of the attempt to manufacture hardware and sporting goods led to the bankruptcy of the Winchester Company in 1931, and its purchase by the Western Cartridge Company of East Alton, Illinois, an Olin Corporation subsidiary.

John Olin's personal interest in shotguns stimulated new Winchester cartridge development work, which had ceased during wartime production of established arms and ammunition designs, and had languished somewhat afterwards as the non-military small arms market contracted. Winchester gave considerable attention in the 1920s to improvement of the .22 caliber rim fire cartridge for accuracy and match shooting. He also developed one new large caliber cartridge, the .270 Winchester. As the Winchester division of Western Cartridge, the ballistics laboratory created a number of new sporting arms rifle cartridges and shotshells, including the .348 cartridge, along with the M71 rifle to use it. Ballistics tests on new, high velocity ammunition led to experimentation on small caliber cartridges with a large powder volume, and development of three new cartridges--the .220 Swift, .219 Zipper and .218 Bee--all widely used in sporting arms. Other products of 1930s Winchester ballistics research included the soft-tipped jacketed bullet which would expand after impact, with far more lethal effects than the older jacketed bullets and the 12-gauge magnum shotshell.

During this period, and continuing until the end of World War II, the ballistics research group worked in ranges associated with the Winchester ammunition plant off Winchester Avenue, with Tract K remaining closed or leased to outside firms. Beginning in 1940, Winchester for the first time applied its proven ammunition development capability to military purposes,

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creating the .30 M1 carbine cartridge in response to the Army's requirement for a lightweight rifle to replace the .45 pistol used by troops not armed with the Garand, or M1, rifle developed at Springfield. Winchester later developed and produced the M1 carbine around this new cartridge and, along with other contractors, made large quantities of the carbine ammunition during World War II.

In 1946, Edwin Pugsley, Winchester's technical director and principal gun designer, was instrumental in establishing a ballistics research department independent of the ammunition production division, in pursuit of military as well as commercial projects following the recent wartime successes. The new department included ammunition and gun designers, a group devoted to military projects, and a photographic section. Operations centered in Tract K, using some of the factory space there and the firing range, which was modified for ballistics testing and experimentation. Olin also used the six-story factory space for manufacture of polyethylene products into the early 1950s and, after the creation of the larger Olin Mathieson Chemical Corporation in 1954, for chemical research. The Winchester ballistics research photographers assisted in chemical projects (personal communications, Henry Bialecki and Lawrence Faeth, January 3 and 9, 1986).

Other ballistics research facilities included the longer firing ranges at the Tract C ammunition plant across Munson Street (Figure 1), but most ballistics tests took place at the Tract K range, known as 6-K. Photographic recording of bullet or shot flight patterns and impacts became a major feature in ammunition development, with the application of newly-developed, high speed, flash photographic techniques immediately after World War II. The Winchester Division's research photographic section used standard applications of this new industrial photography, as well as time displacement photography of moving rifle/shotgun parts developed on-site by Karl Maier, to become one of the best known facilities of this type in the country. Supervisory of Photography Lawrence Faeth's pictures appeared in many popular magazines and were an important component of the Winchester Division's promotional activities in the competitive sporting arms market. By the early 1950s, new electronic chronographs for measuring bullet velocity and equipment for testing small arms pressure behavior became part of the research methods employed in the range building, along with severe weather or environment tests of small arms performance. Most of these latter techniques appear to have been common among contemporary private small arms manufacturers (personal communications, Robert Reichenbach and Lawrence Faeth, January 7 and 9, 1986).

The ballistics research group developed several types of new spring ammunition including the .264 Magnum, .284 Winchester, .338 Magnum, .256 Winchester, and the .22 Winchester magnum rimfire cartridges. Experiments with aluminum shotshell cases did not lead to a commercially-successful production, but the

plastic shotshell, now universally used for shotgun ammunition, was developed at New Haven in 1960-62. There were also tests in the range on new sporting arms, such as the Model 50 shotgun developed by David "Carbine" Williams, who had earlier been instrumental in the M1 carbine design. The Winchester Division conducted a number of military research projects in the 1960s, including the Army "SPIW" series of weapons, which used controlled-burst, dart-type projectiles, and the duplex of multiple cartridge bullet. None of the military projects resulted in production contracts which, in light of a contracting sporting arms market, contributed to the demise of the research department.

Olin ceased production of commercial ammunition at New Haven in 1956, concentrating all such operations at the Western Cartridge plant in East Alton. Production of military ammunition continued in New Haven until 1970. In 1972, Olin disbanded the research department, moving its principal functions to East Alton, and closed the firing ranges in the inactive ammunition plant north of Munson Street. In New Haven, a smaller staff conducted quality control work and research for product liability cases in the 6-K range, while, in the early 1980s, developing new .307 and .356 Winchester cartridges. Olin sold the Winchester Division in 1981 to the U. S. Repeating Arms Company, which closed the range when funds for new product development were no longer available.

PART II. DESCRIPTIVE INFORMATION

Tract K is bounded by Munson Street to the north, Winchester Avenue to the northeast, and tracks of the former New York, New Haven and Hartford Railroad abutted by Canal Street to the southwest (Figure 1). Prior to World War I, the property had a small Winchester storage facility on Munson Street and several frame dwellings along Winchester Avenue (Sanborn-Perris Map Company 1901; Streuli and Puckhafer 1911). All Tract K buildings erected during World War I remain in their original configuration and with much of their original exterior appearance. The only substantial changes around Tract K have been construction of public housing across Canal Street after World War II, and recent demolition of Winchester plant facilities immediately north of Munson Street. The principal Tract K structures include two parallel, six-story concrete factories, each 50 x 250 feet, joined at the north end by a similar 140 feet wide structure which follows adjacent street and rail alignments. Two four-story, steel-framed, metal-sided structures also bridge the ends of the parallel factories. The firing range, 160 x 78.5 feet, joins the western factory at its southern end and is surrounded to the southeast and northwest by a fenced, paved area.

Although the range building overlies footings originally intended for an extension of the Tract K factories, it apparently rests primarily on shallow timber sills. Detailed foundation components remain undocumented. Except for

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the concrete walls and roof of the southernmost 20 feet, the range buildings was originally a brick-clad, timber-framed structure with a slag-covered, slightly pitched plank roof. The northernmost 40 feet is about 17.25 feet high, with a 10.5 foot ceiling under open space used for ventilation and, after 1945, ventilating equipment over the firing rooms. Half of this section was apparently an open space during World War I, used for batching and test preparations of Enfield rifles; the remainder, adjacent to the ranges proper, was divided into firing rooms with undocumented sliding doors. The western exterior of this section, abutting the railroad tracks, originally had two windows and a door which were bricked over during the modifications after World War II. A single steel door on the east side of this section replaced an original double door. The only original exterior opening appears to be a multi-paned window south of the latter door, with two other doors further south removed or replaced (Westcott and Mapes, 1944; personnel communication, Henry Bialecki, January 3, 1986).

The longest section of the range building, extending for 100 feet south of the section just described, is 7.5 feet high, and originally consisted of eight timber-framed, timber-floored corridors, with posts 10 feet apart longitudinally and about 9 feet apart across most transverse distances. An additional row of posts, sills, and beams runs under the roof center, giving present Range 5 added but superfluous width. During World War I, vertical planks formed range walls, which survive in more or less original form only in the two walls separating ranges 2-4. The concrete south end of the building is 12 feet high, with a 6-foot wide corridor crossing all range ends and the remaining 14 feet originally floored with wood blocks, divided by timber walls, and filled with sand fronting armor plate.,

Modifications for the later research department included installation of accoustic tile on walls north of most ranges, asbestos-treated soundproof material on range ceilings, extensive new ventilation and electrical utilities, rebuilding of most or all firing room doors with firing ports and some instrument ports, enclosure of most range walls with brick or concrete block, installation of a concrete floor in the northern 140 feet of the building, addition of new armor plate at the south end, and possibly the addition of steel doors separating the ranges along the southern transverse corridor. Ranges 1 and 2, on the east side of the building, were shortened to 50 foot lengths with concrete block end walls, for use as shotgun ranges; the space south of these ranges became two storage areas (Westcott and Maps, 1944; personnel communication, Henry Bialecki, January 3, 1986).

With the exception of a ballistic pendulum installed at the end of Range 3 during the 1960s, there was little permanent equipment installed in the range building. Most testing involved setting up portable electronic and photographic equipment, with the open space at the north end used for test staging. Ranges 1 and 2 served as shotgun function testing stations, with the

latter also used for shotgun pressure and velocity tests. Impact measurements tests on weapon actions took place in Range 3, with adjacent Range 4 usually used for general rifle testing purposes. In Range 5, designating two separate corridors, Winchester researchers used the south corridor for function testing and the north for rifle pressure and velocity tests along with pistol center fire cartridge tests. Range 6, also double-corridorred, served for pattern range and accuracy testing of rifles and shotguns. There is today virtually no trace of operations conducted for Enfeld rifle production and, after the recent closing of the range, U. S. Repeating Arms Company removed any portable remains of test facilities, including the somewhat hazardous lead-filled sand banks and asbestos-treated accoustic ceiling material. Only the ventilating ducts, firing and instrument ports, severely-scarred range surfaces, steel doors at range ends, and the armor plate at the south end of the building retain evidence of past range building activities (personnel communications, Robert Reichenbach and Lawrence Faeth, January 7 and 9, 1986).

PART III. SOURCES OF INFORMATION

Original Drawings

The only drawings discovered during this documentation is a set of proposed modifications, some of which were completed, found in Olin offices in Tract K:

Westcott and Mapes, Inc.

1944 Winchester Repeating Arms Company/Division of Western
Cartridge Co./New Haven, Connecticut: Repairs and
Modifications to Building 6, Tract K for Rifle Range.
5 sheets.

These drawings, which contain little important information, may be found at Science Park Development Corporation, 5 Science Park, New Haven, Connecticut.

Historic Views

There are many views published in magazines, such as True, Argosy, and Guns, showing spectacular impact or velocity events: bullets or shotshells penetrating or demolishing various materials, or, in a famous instance, heading directly at the viewer (LIFE Magazine, August 1956). A smaller number of published views show research operations in the range building:

Kuhlhoff, Pete

1958 "Shotgun Doctor", Argosy, November 1958, pp. 62-63, 86-87,
includes a view of a time displacement experiment conducted
by Karl Maier.

McMahon, Bob

- 1956 Ballistics problem solved photographically, in Industrial Photography, March 1956, includes a high-speed motion picture test in Range 6.

Science Illustrated

- 1948 Factory-made rifle uses controlled by precision tests, November 1948, pp. 52-53, includes full page view of a velocity recoil test in Range 5.

Interviews

1. Henry Bialecki
 c/o Olin Corporation
 91 Shelton Avenue
 New Haven, Connecticut 06511

Interviewed January 3, 1986. Mr. Bialecki was formerly General Manager and Financial Officer at Olin.

2. Lawrence Faeth
 39 Breezy Court
 Hamden, Connecticut 06518

Interviewed January 9, 1986. Mr. Faeth was formerly Supervisor of Photography in the Winchester Research Group.

3. Robert Reichenbach
 U. S. Repeating Arms Company
 275 Winchester Avenue
 New Haven, Connecticut 06511

Interviewed January 7, 1986. Mr. Reichenbach is currently Supervisor of the Quality Control Laboratory, and began work at the Winchester Research Group in 1960.

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n.d. Dana Collection: New Haven Old and New, vol. 122.

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1966 The Winchester Way: One Hundred Years of Arms and
Ammunition.

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1923 Insurance Maps of New Haven, Connecticut. Vol. 2.
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Boston: Walker Lithography and Publishing Company.

Williamson, Harold F.

1952 Winchester, the Gun That Won the West.
Washington: Combat Forces Press.

Likely Sources Not Yet Investigated

Later issues of Winchester Life, an employee magazine begun in 1942, and subsequent employee publications, may have material on the range building or the Winchester Research Company; this journal is not indexed. The New Haven Register may contain pertinent material, but its index begins after most research activities ended. The Dana Collection cited above appears to have culled the most useful articles on Winchester. Finally, there may be unpublished photographs in the Olin offices in East Alton, Illinois, or in offices of the U. S. Repeating Arms Company in New Haven.

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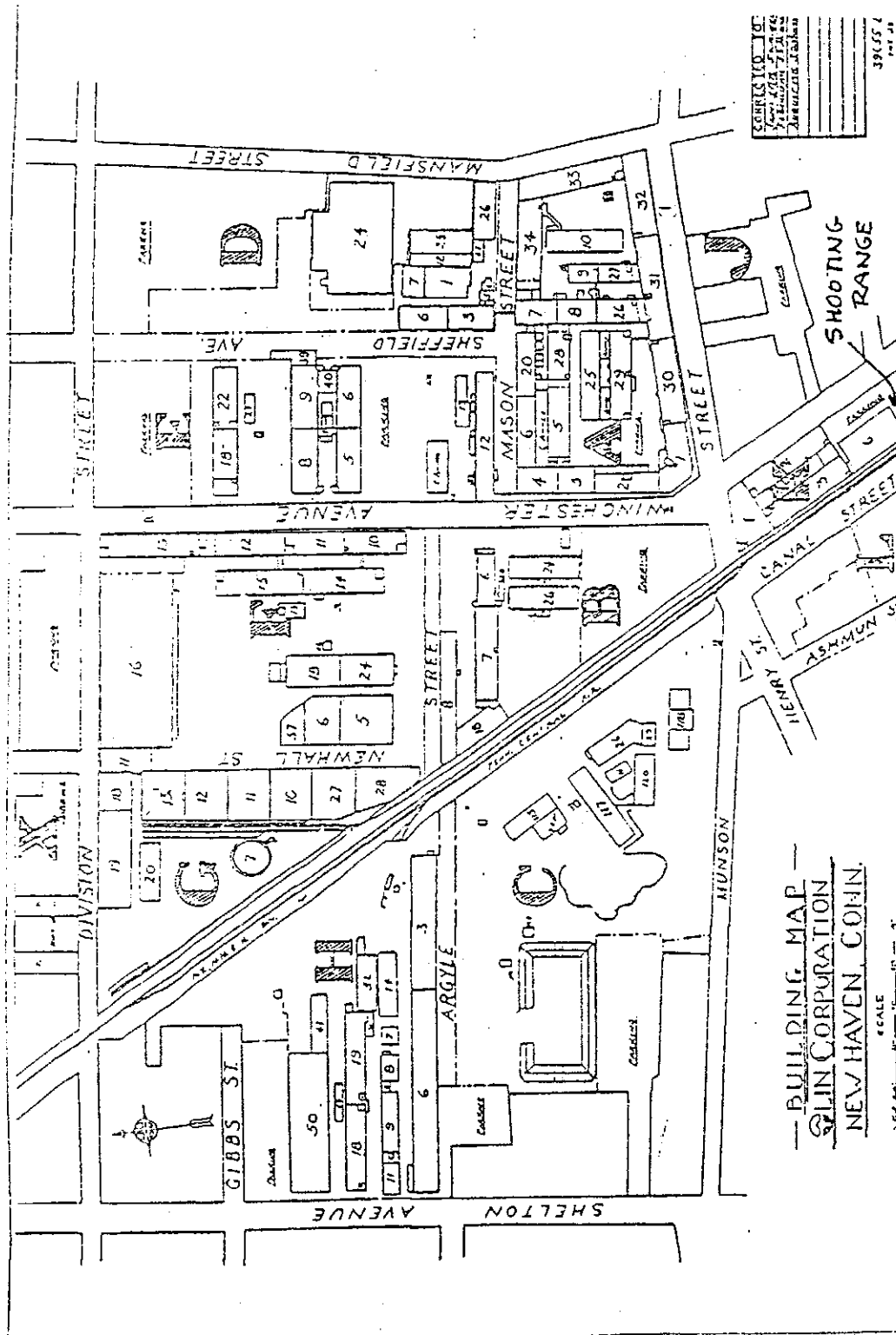


Figure 1. SHOOTING RANGE LOCATION IN WINCHESTER COMPLEX, 1978

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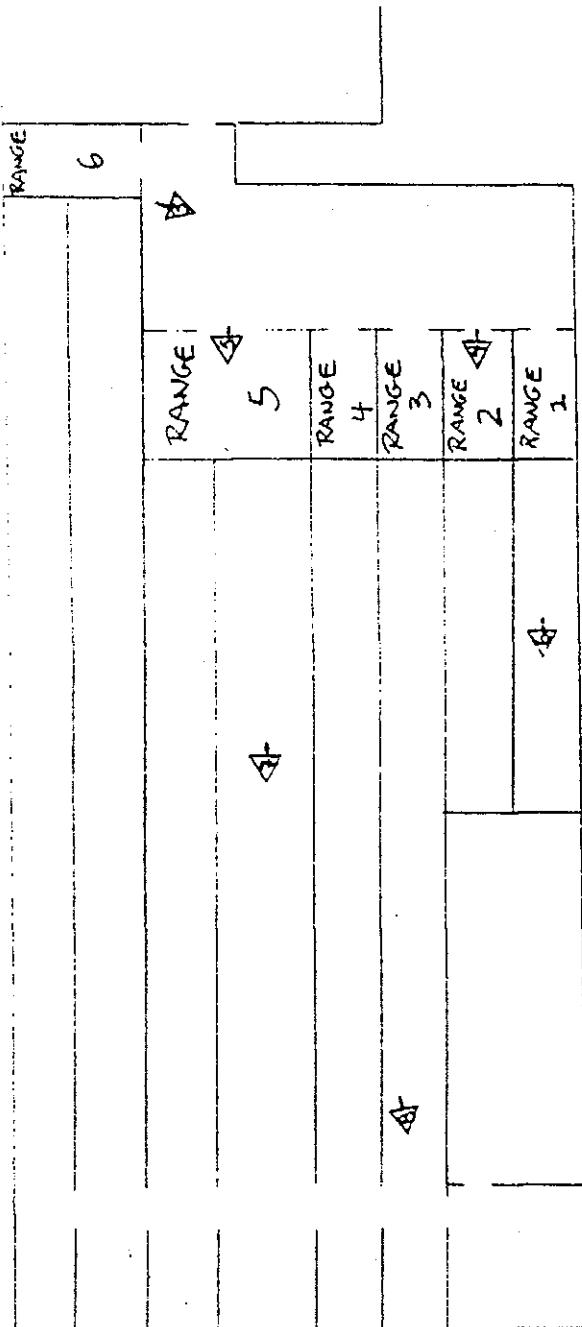


Figure 2. SKETCH PLAN OF SHOOTING RANGE, AND PHOTO LOCATIONS